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### **An Idea That Just Took Off**

Technology: From the engineers behind the Gossamer Albatross comes a solar plane that would bounce communications signals straight into homes. The only remaining hurdle is money.

By DAVID COLKER, Times Staff Writer

AeroVironment Inc., birthplace of the famed Gossamer Albatross human-powered airplane--has spent years developing a solar-powered aircraft so light and efficient that it could stay aloft for six months.

The Helios, as the solar plane is called, would circle slowly at altitudes up to 100,000 feet above cities, relaying ultra-fast Internet, television and telephone signals directly to homes, like a miniature satellite. Its power would come from solar cells mounted on the wings.

A major technological barrier on the project was conquered earlier this year, company officials say, with the development of a lightweight, self-contained fuel cell to power Helios when the sun goes down.

With the known scientific and engineering hurdles overcome, AeroVironment says it needs just one more thing to move Helios beyond the prototype stage--\$300 million.

"That's what we estimate it will take to move into commercial service," said Tim Conver, chief executive of Monrovia-based AeroVironment and the man whose job it is to secure the capital needed to launch a fleet of planes.

That's on top of the \$50 million the company has already spent on development--some of which was ponied up by NASA, which wants

to use Helios for atmospheric studies and other projects.

"It's one of the most exciting projects we've been involved in," said John Del Frate, project manager of NASA's solar aircraft program, who says that if Helios can be put to commercial use, economies of scale would drive down production costs. AeroVironment, founded in 1971, has a distinguished record in the alternative-power field.

In 1979, its Gossamer Albatross drew worldwide attention when it flew across the English Channel, powered only by the pilot pumping away at bicycle-like pedals to turn the propeller.

Two years later, the company's Solar Challenger made the first sun-powered flight across the channel and, in 1987, its Sunraycer won a race across Australia by solar-powered cars, beating the nearest competitor by two days.

A Helios prototype was test-flown six times last year at Edwards Air Force Base. Conver takes along videos of the NASA-sponsored tests as he goes searching for funding.

"It helps a lot when you can show a video of a real airplane, really flying," he said. "It's a lot more credible than me standing there waving my arms around."

But even with proof that the thing actually flies, getting financing from venture capitalists is far from assured.

"The VC folks have gotten very spoiled in the last couple of years," said Jon B. Kutler, president of Quarterdeck Investment Partners Inc., a Los Angeles firm that analyzes the aerospace business. Venture capitalists, he said, crave relatively low-cost start-ups--such as many Internet businesses--that have the potential to explode in value.

"They don't want a single. They don't want a double. It's a home run or nothing," Kutler said.

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That attitude persists, he said, even with the recent downturn in tech stocks and other speculative issues. "Expectations die hard," he said.

But Conver, 56, believes that the recent instability in the high-tech market could help more real-world ventures.

"What existed up until six months ago was a real preference in the investor for 'dot-coms,' which is basically an idea and software and then a ton of marketing," Conver said.

"In our enterprise, there is a lot of hardware, a lot of software and a lot of regulatory and manufacturing issues. It is more complicated and costly," he said. "But when you realize that what we are building is a wireless infrastructure with a compelling economic advantage, it makes a lot of sense."

That infrastructure has the potential to be very lucrative.

Satellites and fiber-optic cables convey digital information with great speed around the globe, but the information stream slows mightily as it enters what has become known in the telecom world as the "last mile"--the distance between satellite/fiber-optic terminals and homes and offices.

Although some businesses and residences have access to expensive, highly efficient cables that cover that last mile, the vast majority of local connections are via standard telephone or cable-TV lines. Broadband technologies, such as DSL and cable modems, greatly increase the data speed across the last mile, but wireless offers the potential to up the ante considerably.

The Helios commercial plan calls for bouncing data-rich signals directly to local homes and offices at a fraction of the cost of a satellite operation.

Each reusable Helios vehicle will cost between \$3 million to \$5 million to manufacture, depending on the volume in produced, said NASA's Del Frate. The cost of a communications satellite, including its launch rocket, is about \$250 million, he said.

Although Conver declined to discuss potential investors in detail, he said telecom companies, such as the Baby Bells, would be valued additions to the Helios team.

In March, AeroVironment announced it had signed a memorandum of understanding with a Taiwanese government agency, the Wireless Communication Strategic Alliance, calling for both to explore ways that Helios could be used in that country.

The solar plane is the latest attempt by the privately held company to expand from a highly respected but relatively small research enterprise into a bigger player with major production spinoffs.

Its high-profile founder, Paul MacCready, remains as chairman but no longer runs the day-to-day operations. Conver, who has a master's degree in business from UCLA and previously ran a division of Whittaker Corp., came aboard in 1990.

The company employs 150 people and derives about a third of its income from manufacturing products such as rapid-charge units for electric vehicles. Most of its income comes from research contracts.

The theoretical advantages of Helios are alluring.

"The technology is just elegant," said Jack Kyser, chief economist for the Los Angeles County Development Corp., who has followed the project. "It could eliminate so much stuff in the long run--telephone wires, cell-phone towers."

But Helios has some competition. Other companies are touting schemes involving manned aircraft, lasers and even blimps. Among these ventures, Helios is arguably the most exotic.

"It might be a little too cutting edge for its own good," Kyser said. "It's going to sound very science fiction to people."

Helios' design is so exotic that workers at Edwards AFB--where scores of cutting-edge aircraft have been tested--came out in droves to watch it during test flights, NASA's Del Frate said.

Because Helios does not have to accommodate a pilot, it's essentially one long, graceful wing, powered by a series of propellers, each of which looks like an Art Deco artifact. Its 247-foot wingspan exceeds that of a Boeing 747 or even the biggest operational aircraft made in the United States--the C-5 military transport.

But because Helios is primarily constructed of carbon fiber, Kevlar and Styrofoam, its weight including payload is under 2,100 pounds--less than a fully fueled, single-engine Cessna 172.

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Helios is by far the most expensive project AeroVironment has undertaken, Conver said. It calls upon the company's nearly 30 years of research into cutting-edge materials and engineering.

"Everything about this project relates to weight and size," said Ted Wierzbanski, director of the AeroVironment division that developed Helios's fuel cell. He was standing in an unmarked office building--one of several leased by the company in Monrovia--where the fuel cell was developed. "We had to work out about a dozen critical performance matters on this project that had never been done before."

Turning to a working prototype of the fuel cell, Wierzbanski pointed out a key device called an electrolyzer. Using excess power generated by the aircraft's solar cells during daylight hours, the device separates water stored on board into its two chemical components--hydrogen and oxygen.

When the sun goes down, the process is reversed. The hydrogen and oxygen are reunited inside the fuel cell in a process that produces electricity to power night flight.

The only byproduct of this reunification action is water, which is used to begin the process all over again in the morning.

Because the amount of power produced is relatively small, Wierzbanski said, it is not certain that this type of fuel cell will have widespread application beyond Helios. It does not involve any major technological breakthroughs, he said, but rather innovative engineering.

But Del Frate believes it may find its way into other vehicles.

"There's been some talk about possible compatibilities with space stations as well as satellites," he said. "There are groups out there seeing possible spinoffs."

Meantime, Helios remains the priority project for both AeroVironment and NASA's solar program. The goal, Conver said, is for Helios to start delivering commercial services in 2003.

This funding stage promises to be a white knuckler, perhaps even more so than when AeroVironment and NASA first sent the Helios

prototype into the air.

At any time, some unexpected breakthrough in technology could come along and usurp Helios' goal of being a primary carrier of "last-mile" communications.

Conver says the risk comes with the territory.

"It's the nature of technology," he said. "No one knows what could be around the corner."

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#### Helios

Wingspan: 247 feet

Fuselage length: 12 feet

Wing thickness: 11.5 inches

Weight: 2,048 pounds

Power: Solar and fuel cells

Propellers: 14

Cruising speed: 19-25 mph

First flight: Sept. 8, 1999

Maximum potential altitude: 100,000 feet

Maximum potential flight duration: 6 months